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Title: Development of a SQUID-based 3He Co-magnetometer Readout for a Neutron Electric Dipole Moment Experiment

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Development of a SQUID-based ^{3}He Co-magnetometer Readout for a Neutron Electric Dipole Moment Experiment

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A discovery of a permanent electric dipole moment (EDM) of the neutron would provide one of the most important low energy tests of the discrete symmetries beyond the Standard Model of particle physics. A new nEDM search, to be conducted at the Spallation Neutron Source (SNS) at ORNL, is designed to improve the present experimental limit of 10^{-26} e·cm by two orders of magnitude. The experiment is based on the magnetic-resonance technique in which polarized neutrons precess at the Larmor frequency when placed in a static magnetic field; a non-zero EDM would be evident as a difference in precession frequency when a strong electric field is applied parallel vs. anti-parallel to the magnetic field. In addition to its role as neutron spin-analyzer via the spin-dependent n+^{3}He nuclear capture process, polarized helium-3 (which has negligible EDM) will serve as co-magnetometer to correct for drifts in the magnetic field. The helium-3 precession signal will be read out by SQUID gradiometers, with a noise requirement of <1 fT/Hz$^{1/2}$ (referred to a half-gradiometer). We describe efforts to implement the SQUID system into the large, complex, nEDM cryostat.